

CLAIMS

What is claimed is:

1. A planetary differential comprising:
a differential case rotatable about an axis, said differential case including a cover, a housing, an annulus gear, and a ring gear, said differential case defining a differential cavity having a clutch cavity and a planet cavity; and
a retainer plate coupled to said housing and separating said clutch cavity from said planet cavity.
2. The planetary differential of claim 1 wherein the axial position of said retainer plate relative to said housing is adjustable.
3. The planetary differential of claim 1 wherein said housing includes a threaded section, said planetary carrier includes a pedestaled flange and an axial hub, and wherein said clutch cavity is bounded by said retainer plate, axial hub, and housing.
4. The planetary differential of claim 3 wherein said housing has a threaded segment, wherein the retainer plate has threads engaging said threaded segment to permit adjustment of the axial position of said retainer plate relative to said housing.
5. The planetary differential of claim 1 wherein said housing defines said clutch cavity and includes an axial opening, said retainer plate coupled to said housing between said clutch cavity and said axial opening.

6. The planetary differential of claim 5 wherein said cover is fastened to said annulus gear to form said planet cavity, said ring gear is fastened to said annulus gear, and said housing is fastened to said ring gear or said annulus gear.

7. The planetary differential of claim 5 wherein said ring gear is integral with said annulus gear, said cover is fastened to said integral annulus/ring gear and said housing is fastened to said integral annulus/ring gear.

8. The planetary differential of claim 5 wherein said cover is integral with said annulus gear to form a cover/annulus assembly and wherein said housing and cover/annulus assembly are fastened to said ring gear.

9. The planetary differential of claim 5 wherein housing is integral with said annulus gear to form a housing/annulus assembly and wherein said cover and said housing/annulus assembly are fastened to said ring gear.

10. The planetary differential assembly of claim 5 wherein said cover is integrally formed with said annulus gear and ring gear to form a cover/gear assembly and said housing is fastened to said cover/gear assembly.

11. The planetary differential of claim 1 wherein said retainer plate is coupled to said housing to resist axial forces from said planetary carrier such that said planetary differential is selectively configurable to function as a torque biasing differential or an open differential.

12. The planetary differential of claim 11 further including a planetary gear set disposed within said planet cavity, said planetary gear set including a planetary carrier, inner and outer planet gears, and a sun gear, wherein said inner and outer planet gears are coupled to rotate with and relative to said planetary carrier, wherein said outer planet gears are meshed with said annulus gear, wherein said inner planet gears are meshed with said outer planet gears and said sun gear and wherein said planetary differential includes a clutch pack disposed in said clutch cavity and a clutch actuator operatively coupled to said clutch pack when said planetary differential is configured to function as a torque biasing differential, said clutch pack including first clutch plates fixed to rotate with said housing and second clutch plates fixed to rotate with said planetary carrier, and wherein said retainer plate operatively engages said clutch pack to function as a reactor plate for said clutch pack when said planetary differential is configured to function as a torque biasing differential.

13. A planetary differential for use as an open or torque biasing differential by selectively including or omitting a torque biasing assembly, said planetary differential comprising:

a differential case rotatable about an axis, said differential case including a cover, a housing, an annulus gear, and a ring gear, said differential case defining a differential cavity having a clutch cavity and a planet cavity, said housing defining said clutch cavity and including an axial opening;

a planetary gear set disposed within said planet cavity, said planetary gear set including a planetary carrier, inner and outer planet gears, and a sun gear, said inner and outer planet gears coupled to rotate with and relative to said planetary carrier, said outer planet gears meshed with said annulus gear, said inner planet gears meshed with said outer planet gears and said sun gear; and

a retainer plate coupled to said housing between said clutch cavity and said axial opening to separate said clutch cavity from said planet cavity and to resist axial forces from said planetary carrier.

14. The planetary differential of claim 13 wherein said planetary differential includes a clutch pack disposed in said clutch cavity and a clutch actuator operatively coupled to said clutch pack when said planetary differential is configured to function as a torque biasing differential, said clutch pack including first clutch plates fixed to rotate with said housing and second clutch plates fixed to rotate with said planetary carrier.

15. The planetary differential of claim 14 wherein said retainer plate operatively engages said clutch pack to function as a reactor plate for said clutch pack when said planetary differential is configured to function as a torque biasing differential.

16. A method of manufacturing a planetary differential that is configurable as a torque biasing differential or an open differential, the planetary differential includes a differential case with a cover and a housing, an annulus gear, and a ring gear, the differential case having a clutch cavity and an axial opening defined by the housing and a planet cavity, said method comprising:

coupling a retainer plate to the housing between the clutch cavity and the axial opening;
and

selectively configuring said planetary differential as a torque biasing differential by operably coupling a clutch assembly to the differential case or an open differential by assembling the differential without a clutch assembly.

17. The method of claim 16 wherein the housing further includes a threaded segment between the clutch cavity and the axial opening, wherein the retainer plate has threads, and wherein the step of coupling the retainer plate to the housing includes threadably engaging the retainer threads with the threaded segment.

18. The method of claim 16 further including cold forming one of the housing and cover and joining the cold formed housing or cover to one of the annulus gear and ring gear and the other of the housing and cover.

19. The method of claim 18 further including selectively:

(a) fastening the housing and cover to the annulus gear to provide a housing/annulus/cover assembly and joining the housing/annulus/cover assembly to the ring gear;

(b) joining the housing to the annulus gear to form a housing/annulus assembly, joining the cover to the ring gear to form a ring gear/cover assembly, and joining the housing/annulus gear assembly to the ring gear/cover assembly;

c) joining the cover to the annulus gear to form a cover/annulus assembly, joining the housing to the ring gear to form a housing/ring gear assembly, and joining the cover/annulus assembly to the housing/ring gear assembly; or

(d) joining the annulus gear and ring gear to form an annulus/ring gear assembly, and joining the cover and housing to the annulus/ring gear assembly.

20. The method of claim 19 further including cold forming the other of the housing and cover.

21. The method of claim 20 further including forming the annulus gear integral with the cold formed cover to form an annulus/cover assembly and joining the ring gear and housing to the annulus/cover assembly.

22. The method of claim 20 further including cold forming the annulus gear integral with the cold formed housing to form a housing/annulus assembly, joining the housing/annulus assembly with the ring gear to form a housing/annulus/ring gear assembly, and fastening the cold formed cover to the housing/annulus/ring gear assembly.

23. The method of claim 20 further including cold forming the ring gear and annulus gear with the cover to form a cover/ring/annulus gear assembly and joining the cover/ring/annulus gear assembly to the cold formed housing.

24. The method of claim 18 further including manufacturing said annulus gear integral with said ring gear to form an annulus/ring gear assembly and joining the housing and cover to the annulus/ring gear assembly .